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TITLE : NONIONIC SURFACTANT

ABSTRACT : PURPOSE: To obtain a high-detergency nonionic surfactant which has fluidity at low temperatures and much ease of handling at the time of transport and formulation by adding a specific amount of ethylene oxide and propyrene oxide at random to alcohol which contains a specific amount or more saturated straight-chain higher alcohol with a specific number of carbon.

CONSTITUTION: Alcohols such as palm alcohol and Dovanol used contain 50wt.% or higher of 8 to 18C saturated straight-chain higher alcohol such as n-octyl alcohol. In addition, an average 5 to 15 mols of ethylene oxide and an average 0.3 to 5.0 mols of propyrene oxide are added at random to such higher alcohols. If a nonionic surfactant is manufactured as described above, it is possible to lower the pour point preferably to 25°C and further preferably to 20°C or lower.

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Number of Inventions: 1, application for examination not made (total pages: 4)

54 Title: Nonionic Surfactant

57 Abstract

Constitution: A nonionic compound is obtained by adding randomly, on an average, 5 - 15 moles of ethylene oxide and 0.3 - 5.0 moles of propylene oxide to alcohol, containing at least 50 wt% of saturated linear fatty higher alcohol with 8 - 18 carbon atoms.

Advantage: The nonionic surfactant according to the present invention has a good cleaning performance, an excellent fluidity at low temperatures and can easily be handled on transporting and mixing.

Claims

1. Nonionic surfactant consisting of compounds that are obtained by random addition of, on an average, 5 - 15 moles of ethylene oxide and 0.3 - 5.0 moles of propylene oxide to alcohol, containing at least 50 wt% of saturated linear fatty higher alcohol with 8 - 18 carbon atoms.

Detailed Description of the Invention

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Industrial Field

The present invention relates to a nonionic surfactant that shows a good fluidity at low temperatures, can easily be handled on transportation and mixing, and that has a good cleaning performance.

0002

State of the Art

With respect to demands concerning the handling of liquid or pasty nonionic surfactants in transportation and mixing processes nonionic surfactant are to have an excellent fluidity even at low temperatures. Higher alcohol ethoxylates that are obtained by adding ethylene oxide to higher alcohol with numerous branched alkyl groups are known as surfactants with a good low temperature fluidity but the cleaning performance of these surfactants is inferior to linear alcohol ethoxylates.

0003

Ethoxylates of unsaturated alcohol with unsaturated bonds in the alkyl group also show a good low temperature fluidity but they have an inferior stability due to the unsaturated bonds. JP-A 51-13394 proposes to improve the fluidity of nonionic surfactants by mixing water or solvents to these surfactants but this invention does not improve the fluidity of the surfactants within the processes before admixing water or solvents. This means the fluidity of the surfactant itself is not improved. Furthermore, the solution proposed in JP-A 51-13394 is not desirable because it introduces solvents which do not contribute to the cleaning process.

0004

Objective of the Invention

The present invention creates nonionic surfactants with a good fluidity at low temperatures and an excellent cleaning performance.

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Means to Attain the Objective

Nonionic surfactants according to the present invention are characterized in that they consist of compounds that are obtained by random addition of, on an average, 5 - 15 moles of ethylene oxide and 0.3 - 5.0 moles of propylene oxide to alcohol, containing at least 50 wt% of saturated linear fatty higher alcohol with 8 - 18 carbon atoms.

0006

Embodiments of the Invention

The nonionic surfactant of the invention consists of compounds that are given by random addition of ethylene oxide and propylene oxide to higher alcohol. The alcohol contains at least 50 wt%, preferably at least 60 wt% of at least one or more linear and saturated higher alcohols with 8 - 18, preferably 10 - 18 carbon atoms. Concrete examples for such kind of alcohols are n-octyl alcohol, n-nonyl alcohol, n-decyl alcohol, n-dodecyl alcohol, n-tridecyl alcohol, n-tetradecyl alcohol, n-hexadecyl alcohol and n-octadecyl alcohol. If the amount of linear and saturated higher alcohols is lower than 50 wt% the cleaning performance will deteriorate. Examples for alcohols that fulfil the aforementioned conditions are higher alcohols derived from natural oils and fats, e.g. cocoyl alcohol and palm alcohol, and also synthetic alcohols like Dobanol (Mitsubishi Petrochemical) and Diadol (Mitsubishi Chemical Industries).

0007

On an average 5 - 15, preferably 7 - 15 moles of ethylene oxide are added to 1 mol of the higher alcohol. If the average number of added ethylene oxide molecules exceeds the given range the resultant nonionic surfactant will be insufficient for practical use due to an unsatisfying cleaning performance. On an average 0.3 - 5, preferably 0.5 - 4 moles of propylene oxide are added to 1 mol of the higher alcohol. If this figure is below 0.3 the lowering of the pour point will be insufficient and it will be problematic to handle the surfactant at low temperatures. If the average number of added propylene oxide molecules exceeds 5 a lowering of the pour point is observed but in this case the cleaning performance will be inferior.

0008

It is necessary to add ethylene oxide and propylene oxide randomly because of no lowering of the pour point will be obtained when the both alkylene oxides are added successively, i.e. the ethylene oxide is added before the propylene oxide or the other way round. The method for the random addition of the both types of alkylene oxide is not restricted in any way, for example ethylene oxide and propylene oxide can be introduced into the reactor as an admixture with a definite mixing ratio or they can be introduced simultaneously into the reactor through separated nozzles with a definite ratio and then be forced to react within the reactor.

0009

It is an objective of the present invention to lower the pour point of nonionic surfactant. The pour point will preferably be at 25 °C or lower and, even more preferably, 20 °C or lower. By such a lowering of the pour point it is possible to improve both the low temperature handlability and the cleaning performance as intended by the present invention. Speaking more concretely, it is possible to achieve the lowering of the pour point by increasing the content of higher alcohol according to the present invention within the alcohol, that is used as raw material for addition of alkylene oxide, or by controlling the carbon number distribution and the average number of added ethylene oxide and propylene oxide molecules.

0010

The nonionic surfactant of this invention can be used e.g. in general purpose detergents, scouring agents, antirust agents, emulsifiers, and dispersing agents. They are especially ideal for use in detergents for cleaning clothes and dishes that can use this nonionic surfactant as main active ingredient. 102 23-24, 27-29 103

0011

To these detergents for cleaning clothes and dishes and for kitchen use other compounds, that are commonly known as ingredients of such detergents, can be admixed besides the nonionic surfactants of the present invention. Concrete examples for such ingredients are surfactants, e.g. anionic and nonionic surfactants, sequestering agents for divalent metal ions, e.g. nitrilo-triacetic acid salts, ethylene diamine-tetracetic acid salts, citric acid salts, and polyacrylic acid salts, alkali builders as e.g. carbonates and silicates, inorganic builders as

zeolite, sulfates and sulfites, soil redeposition inhibitors as polyethylene glycol, hydrotropes as p-toluene sulfonic acid and ethanol, enzymes, dyes, and fragrances.

0012

Advantages of the Invention

The nonionic surfactant of the present invention has a good cleaning performance, an excellent fluidity at low temperatures and can easily be handled on transporting and mixing.

0013

Examples

The present invention will now be further illustrated by the following examples.

Example 1

1. Reaction

150 g of lauryl alcohol and 2.4 g of potassium hydroxide were given into an autoclave, and after purging with nitrogen, the ingredients were heated while being stirred. Then a liquid admixture of 390 g of ethylene oxide and 140 g of propylene oxide was introduced into the autoclave while keeping the temperature at 120 °C and the pressure at 2 kg/cm^2. After a reaction time of about 8 hrs the liquid reaction product was cooled down to 90 °C and neutralized by acetic acid. The hydroxyl value of the obtained nonionic surfactant was 66.38 KOH/g. From the results of H[1]NMR and the hydroxyl value it was found that 11 moles of ethylene oxide and 3 moles of propylene oxide were added, by C13NMR it was found that ethylene oxide and propylene oxide were added randomly.

0014

2. Pour Point Determination

The pour point was determined according to JIS-K-2269 and was 7.5 °C. Compared to a nonionic surfactant which is obtained by adding 11 moles of ethylene oxide to the same alcohol and which has a pour point of 25 °C, the nonionic surfactant of this working example showed an improved fluidity.

0015

3. Cleaning Performance (kitchen use detergents)

A kitchen use detergent composed as in table 1 was prepared using the nonionic surfactant of the present invention as described above. The cleaning index (measured according to JIS-K-3362, Lehnartz[1] method) was 102. Compared to a nonionic surfactant which is obtained by adding only 11 moles of ethylene oxide to the same alcohol and whose cleaning index was set to 100, almost no difference was observed.

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[1] phonetic

0016

Table 1: Composition of a Kitchen Use Detergent

ingredients	wt%
nonionic surfactant	17
lauric acid diethanol amide	5
ethanol	3
sodium p-toluene sulfonate	1.5
sodium benzoate	0.5
water	balance

0017

4. Cleaning Performance (detergent for clothes)

A detergent for clothes with a composition as in table 2 was prepared using the nonionic surfactant of the present invention as described above. The cleaning index (measured according to the "wet artificially soiled cloth method" as described in Yukagaku 30 (7) 432-441 (1981)) was 100. Compared to a nonionic surfactant which is obtained by adding only 11 moles of ethylene oxide to the same alcohol and whose cleaning index was set to 100, almost no difference was observed.

0018

Table 2: Composition of a Detergent for Clothes

ingredients	wt%
nonionic surfactant	20
soap	2
PEG #6000	1
zeolite	30
soda ash	30
sodium sulfate	balance

The results given above are arranged in the following table 3.

0019

Table 3: Properties and Evaluation Results

	Ex. 1	Comp. Ex. 1
raw alcohol	lauryl alcohol	
added ethylene oxide moles	11	11
added propylene oxide moles	3	0
type of addition	random	-
pour point (°C)	7.5	25
cleaning performance (detergent for clothes)	102	100
cleaning performance (kitchen use detergent)	101[2]	100

[2] perhaps a misprint, compare paragraph 0015

Examples 2 ~ 3, Comparison Examples 2 ~ 9

Nonionic surfactants were synthesized and evaluated in the same manner as in example 1 and comparison example 1. The results are arranged in the following tables.

0020

Table 4: Properties and Evaluation Results

	Ex. 2	Comp. Ex. 2
raw alcohol	cocoyl alcohol*	
added ethylene oxide moles	8	8
added propylene oxide moles	2	0
type of addition	random	-
pour point (°C)	5.0	27.5
cleaning performance (detergent for clothes)	105	100
cleaning performance (kitchen use detergent)	102	100

*: cocoyl alcohol: contains 80 wt% of C8-18 saturated linear higher alcohol

0021

Table 5: Properties and Evaluation Results

	Ex. 3	Comp. Ex. 3
raw alcohol	Dobanol 23*	
added ethylene oxide moles	10	10
added propylene oxide moles	1.5	0
type of addition	random	-
pour point (°C)	2.5	25
cleaning performance (detergent for clothes)	104	100
cleaning performance (kitchen use detergent)	102	100

*: Dobanol 23: iso-saturated alcohol (mixture of C12, C13 alcohol), contains 87 wt% of saturated linear alcohol

0022

Table 6: Properties and Evaluation Results

	Comp. Ex. 4	Comp. Ex. 5	Comp. Ex. 6
raw alcohol		cocoyl alcohol*	
added ethylene oxide moles	8	8	8
added propylene oxide moles	1.5	1.5	0
type of addition	terminal block	central block	-
pour point (°C)	25.0	22.5	27.5
cleaning performance (detergent for clothes)	90	95	100
cleaning performance (kitchen use detergent)	88	95	100

For determination of the cleaning performance index the results of the nonionic surfactant of Comp. Ex. 6 were set to 100.

0023

Table 7: Properties and Evaluation Results

	Comp. Ex. 7	Comp. Ex. 8	Comp. Ex. 9
raw alcohol		cocoyl alcohol	
added ethylene oxide moles	20	4	3
added propylene oxide moles	3	1	8
type of addition	random	random	random
pour point (°C)	5.0	17.5	max. 0 °C
cleaning performance (detergent for clothes)	75	70	80
cleaning performance (kitchen use detergent)	40	68	70

For determination of the cleaning performance index the results of the nonionic surfactant of Comp. Ex. 6 were set to 100.